LAWRENCE BERKELEY NATIONAL LABORATORY

ENVIRONMENT, HEALTH AND SAFETY DIVISION

ENVIRONMENTAL SERVICES GROUP

QUALITY ASSURANCE PROJECT PLAN

for the

Radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAPs)

40 CFR 61, Appendix B, Method 114, Paragraph 4.10

Revision 3
November 8, 2001
Implementation Date
December 1, 2001

REVIEW AND APPROVAL

Prepared By:______________________________ **Date** _______________
Linnea Wahl,
Environmental Services Group

Reviewed By:______________________________ **Date** _______________
Michael Ruggieri,
Environmental Services Group

Reviewed By:______________________________ **Date** _______________
Otis Wong,
Office of Assessment and Assurance

Reviewed By:______________________________ **Date** _______________
Jim Floyd,
Technical Services Group Leader

Approved By:______________________________ **Date** _______________
Ron Pauer,
Environmental Services Group Leader

Approved By:______________________________ **Date** _______________
Gary Zeman,
Environmental and Radiation Protection Group Leader

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP, Plan) describes the Lawrence Berkeley National Laboratory (Berkeley Lab) quality assurance program for air emission measurements conducted under the radionuclide National Emission Standard for Hazardous Air Pollutants (NESHAP), 40 CFR 61, Subpart H (EPA, 2000).

The QAPP describes the following: Berkeley Lab's quality assurance policies (Section 1.1); organizational responsibilities (Section 2); procedures (Sections 3-8); administrative control for response to unexpected emissions (Section 3); steps to assure measurements are representative (Section 4.2), are of known precision and accuracy (Section 5), and are within data quality specifications (Section 5); quality control methods (Section 6); methods for tracking radioanalytical samples (Section 7); audits of the emission monitoring program (Section 8); corrective action for quality assurance (QA) deficiencies (Section 9); and emission monitoring program reporting practices (Section 10).

1.1 Scope

Overall, Berkeley Lab site quality assurance programs are conducted through the implementation of the *Berkeley Lab Operating and Assurance Plan* (OAP), PUB-3111 (Berkeley Lab, 2000d), which implements the QA requirements of Berkeley Lab's contract with the Department of Energy (DOE). The Environmental Services Group (ESG) conducts the NESHAP monitoring program.

The QAPP addresses the QA requirements of Title 40 of the Code of Federal Regulations (CFR), Part 61, Appendix B, Method 114, *Test Methods for Measuring Radionuclide Emissions from Stationary Sources,* Section 4, *Quality Assurance Methods* (EPA, 2000). This QAPP specifically fulfills the documentation requirement of Method 114, Paragraph 4.10.

1.2 Site Description

Berkeley Lab is a multipurpose national laboratory managed by the University of California (UC) for DOE. Berkeley Lab's major role is to conduct basic and applied research in biology, physics, chemistry, materials, and energy. Berkeley Lab is situated on an 80-hectare (200-acre) site owned by the University of California on the west-facing slope of the Berkeley Hills, above the main campus of the University of California at Berkeley. The site is located five kilometers (three miles) east of San Francisco Bay. The Laboratory conducts activities on the Berkeley Lab main site, at additional facilities located on the University campus, and in the cities of Berkeley, Emeryville and Walnut Creek. (Berkeley Lab, 2001e).

Berkeley Lab employs a wide variety of radionuclides in its radiochemical and biomedical research programs. The most widely used radionuclides in research programs are H-3, C-14, F-18, P-32, S-35, and I-125. Also, radioactive gases are produced in beam line areas within the shielded vaults of particle accelerators. Radioactive gases produced by air activation during accelerator operations are mainly short-lived radionuclides such as C-11, N-13, and O-15. Table 1-1 lists the principle radionuclides monitored in Berkeley Lab air emissions (Berkeley Lab, 2001e).

Based on historical emission data, Berkeley Lab has identified only one release point (at Building 75) which requires continuous monitoring per the NESHAP regulations (0.1 mrem/year [0.001 mSv/year]). Based on evaluation of current and historical stack monitoring data and process knowledge, all other Berkeley Lab sources are expected to contribute doses less than the NESHAP threshold limit for continuous monitoring. Berkeley Lab has chosen to conduct continuous monitoring at some facilities in lieu of the minimum requirement of periodic confirmatory sampling or monitoring.

Table 1-1. Principle Radionuclides Monitored in Berkeley Lab Air Emissions

Element (Atomic Number)	Radio-isotope	Principal Radiation Types	Energy (MeV)	Half-Life
Carbon (6)	^{11}C ^{14}C	positron/gamma beta	0.511 0.156	20.5 minutes 5730 years
Cobalt (27)	^{60}Co	beta gamma	0.318 1.33	5.27 years
Copper (29)	^{64}Cu	beta positron beta	0.578 0.650	12.70 hours
Fluorine (9)	^{18}F	positron/gamma	0.511	109.7 minutes
Germanium (32)	^{68}Ge	electron capture	0.7	288 days
Hydrogen /Tritium (1)	^{3}H	beta	0.0186	12.28 years
Iodine (53)	^{123}I ^{125}I ^{131}I	electron capture/gamma gamma beta gamma	0.159 0.027 0.606 0.159	13.1 days 60.14 days 8.04 days
Iron (26)	^{55}Fe ^{59}Fe	electron capture/gamma beta gamma	0.475 1.100	2.73 years 44.51 days
Manganese (25)	^{54}Mn	electron capture/gamma	0.834	312 days
Nitrogen (7)	^{13}N	positron/gamma	0.511	9.97 minutes
Oxygen (8)	^{15}O	positron/gamma	0.511	122 seconds
Phosphorus (15)	^{32}P	beta	1.71	14.3 days
Radium (88)	^{226}Ra	alpha gamma	4.784 0.186	1.60×10^{3} years
Sodium (11)	^{22}Na	positron gamma	0.545 1.27	2.605 years
Sulfur (16)	^{35}S	beta	0.167	87.44 days
Thorium (90)	^{232}Th	alpha beta	4.01 0.04	1.4×10^{10} years
Uranium (92)	^{233}U	alpha	4.825	1.59×10^{5} years

The Berkeley Lab facilities with potential radiological air emissions are described in Section 1.3. Some facilities, which are in close proximity, are grouped together for the purpose of modeling potential offsite dose consequences. Facility functions and monitoring requirements will change over time and the descriptions below reflect the conditions when the QAPP was revised. When periodic confirmatory measurements are required, Berkeley Lab generally performs continuous sampling with offline analyses. For the smallest release points, Berkeley Lab conducts periodic confirmatory measurement by control of the radiological inventory through Radiological Work Authorization/Permit (RWA/RWP) and periodic evaluation.

1.3 Facility Descriptions

Building 1 (Donner Laboratory): Donner Laboratory conducts research in nuclear medicine through the use of new chemical probes and new instrumentation for applications to aging, atherosclerosis, and cancer. The building is located on the University of California at Berkeley campus. Many non-LBNL employees (i.e., UC) also share this building for various other research activities. Work is mostly done on bench tops and in hoods.

Building 2 and 6 (Center for Advanced Material Laboratory/Center for X-Ray Optics and Advanced Light Source): The Center for Advanced Material Laboratory does fundamental research in areas of materials science that US Industry and DOE Technology Offices have identified as critical to their missions and objectives. The Center for X-ray Optics addresses national needs in the technical areas of efficient and high precision transport, focusing and spectroscopic analysis of electromagnetic radiation in the soft x-ray and extreme ultraviolet (EUV) regions of the spectrum.

The Advanced Light Source (ALS) is a synchrotron radiation source in the extreme ultraviolet and soft x-ray regions of the spectrum. The ALS injector produces stray neutrons during its operation, which activate the air in the injector vault. As the ALS is a low power accelerator, compared to Berkeley Lab’s other accelerators, its inventory of air activation products is substantially lower than, for instance, the 88-inch Cyclotron. The maximum potential annual releases of N-13 and O-15 (the important air activation products of the ALS) are computed to be 0.084 Ci (3×10^9 Bq) and 0.006 Ci (2×10^8 Bq), respectively.

Building 3 (Calvin Laboratory): The Calvin Laboratory conducts basic research on the dynamics of living cells and on the interaction of radiant energy with organic matter. Cell and molecular biology studies are performed in this laboratory. As with Building 1, this building is also located on the University of California at Berkeley campus. Building 3 is wholly occupied by Berkeley Lab personnel. Work is done on bench tops and in hoods.

Building 26 and 76 (Medical Services & Bioassay/Radioanalytical Laboratory and Counting Laboratory): Low-level radiochemical analyses of bioassay and environmental samples and hazardous waste are performed by Berkeley Lab's radiochemistry analytical laboratory. In addition**,** Building 76 has some counter calibration sources. The analytical laboratory is the only radionuclide user in these buildings. Only trace quantities of radionuclides are used in sample spiking and standards preparation.

Building 55 and 56 (Research Medicine & Radiation Biophysics and Biomedical Isotope Facility): The Research Medicine & Radiation Biophysics and Biomedical Isotope Facility develops radiopharmaceuticals, and advanced medical imaging technologies including positron emission tomography (PET), single photon emission computed tomography (SPECT), and nuclear magnetic resonance imaging (MRI) and applies them to the study of atherosclerosis, heart disease, aging, neurological and psychiatric diseases, and cancer. Building 56 houses a small accelerator to produce F-18 for PET and C-11 for other experimental studies. Two release points in Building 56 are continuously monitored (real-time) for positron emitters and other release points in Building 55 are continuously sampled with off-line analysis. The continuous real-time monitoring performed at Building 56 is more rigorous and comprehensive than the periodic confirmatory sampling that is required for NESHAP compliance.

Buildings 70 & 70A (Nuclear, Materials, Chemicals, Earth Sciences, and Life Sciences): The Nuclear Science programs include nuclear structure and reactions, relativistic nuclear collisions, nuclear and particle astrophysics, nuclear data evaluation, and nuclear theory. Materials Sciences performs research in the discovery, creation, characterization, and development of new materials and materials phenomena. The Chemical Sciences Programs conducts research in the areas of chemical physics and the dynamics of chemical reactions, the structure and reactivity of transient species, electron spectroscopy, surface chemistry and catalysis, electrochemistry, chemistry of the actinide elements and their relationship to environmental issues, and atomic physics. The Earth Sciences programs perform fundamental and applied research related to energy and environmental resources. Programs carried out in these facilities include super-heavy nuclear studies, waste migration studies (tracer amounts), and nuclear chemical studies. There are also two Life Science groups in 70A. Research activities using radioactive material are carried out by various research groups in many small laboratories within the two buildings.

Building 71 (Heavy Ion Accelerator) The Heavy Ion Accelerator is no longer in operation.

Building 72 (National Center for Electron Microscopy (NCEM)) The NCEM provides the electron microscopy community with advanced instrumentation for electron-optical characterization of materials. The NCEM is a national facility open to qualified researchers in materials science and associated disciplines.

Buildings 74 (Research Medicine), 83 (Cell Biology) and 84 (Human Genome Center): These buildings include a wide variety of cell biology, virology, research medicine, and human genome projects. The Human Genome Center of the Berkeley Laboratory is oriented almost exclusively towards developing and implementing directed methodologies for cost-effective and accurate high throughput human DNA sequencing.

Building 75 (National Tritium Labeling Facility): The National Tritium Labeling Facility (NTLF) is a designated DOE National User Facility engaged in tritium labeling research and development. It offers the US and International biomedical research community a fully equipped laboratory for the synthesis and analysis of tritium labeled compounds. The NTLF is mainly used for activities in which a wide variety of molecules are labeled with tritium and purified for further use in chemical, biochemical, and radiopharmaceutical studies. The radionuclide releases are in the form of tritiated hydrogen gas (HT) and tritiated water (HTO). Building 75 includes the Hillside Stack, which is the only release point at Berkeley Lab that is required to be continuously sampled with off-line analysis. To provide additional data, Berkeley Lab also continuously monitors the Hillside Stack with a real time tritium measurement system.

Building 75A and Building 75 Room 127 (Hazardous Waste Handing Facility/Historical Diffuse and Point Source): Building 75A and Building 75 Room 127 were previously utilized for processing (including compacting) and storing radiological, hazardous and mixed waste. All waste management operations in Building 75A and 75 have been transferred to Building 85. All Radioactive Material Areas (RMAs) in the former waste facility, including the diffuse source of tritium, were decontaminated and decommissioned. Current activities include characterization of legacy radioactive materials.

Building 85 (Hazardous Waste Handling Facility): The Berkeley Lab Hazardous Waste Handling Facility is located in Building 85. Radioactive, mixed and hazardous waste from various laboratories is processed and stored at this Facility for transport to off-site treatment and disposal facilities. Waste processing includes neutralization of corrosives, waste solidification, waste compacting, combining of compatible wastes and lab packing of wastes into drums.

Building 88 (88-inch Cyclotron): The Cyclotron accelerates beams from hydrogen to uranium in support of national programs in nuclear science, biology, medicine, and industrial applications. The primary airborne impact to an offsite individual from this facility is attributable to short-lived air activation radionuclides (mostly positron emitters) produced in the cyclotron vault during the fraction of the beam year when light ions are accelerated. The quantity of activation products is controlled by the fraction of the beam year spent running light ions, and limits on circulating beam current. In addition to
accelerator-produced positrons, small amounts of actinide radionuclides and other radioactive targets and radioisotopes are also used in experimental caves, fume hoods, and glove boxes. The largest release point is continuously monitored (real-time) for

positron emitters. The continuous real-time monitoring performed is more rigorous and comprehensive than the periodic confirmatory monitoring that is required for NESHAP compliance.

2.0 ORGANIZATION AND RESPONSIBILITIES

This section identifies and documents the organizational structure (Section 2.1), responsibilities (Section 2.2), and authorities (Section 2.2) of Berkeley Lab staff conducting the radionuclide NESHAP compliance program. This section satisfies the requirements of 40 CFR 61, Appendix B, Method 114, Section 4.1.

2.1 Berkeley Lab Organizational Structure

The Environmental Services Group of the EH&S Division has lead responsibility for Berkeley Lab NESHAP compliance. Scientific investigators rely on the Environmental Services Group to assist them in accomplishing environmental compliance objectives, including compliance with the radionuclide NESHAP. Berkeley Lab facilities do not establish individualized NESHAP compliance programs within their research areas. Figure 2-1 presents the organizational structure of the EH&S NESHAP Compliance Program and diagrams the flow of communication among these organizations.

2.2 Functional Responsibilities and Levels of Authority

The primary and supporting responsibilities for each NESHAP compliance function are described below. A primary responsibility indicates the party assigned to accomplish the emission monitoring function. Supporting responsibility indicates the party that accomplishes important parts of the emission monitoring function, in coordination with the organization assigned primary responsibility.

Environmental and Radiation Protection (ERP) Group Leader : The ERP Leader has oversight responsibility for the groups that conduct and support the NESHAP compliance program.

Environmental Services Group (ESG) Leader: The ESG Leader is responsible for Berkeley Lab environmental compliance and restoration activities including the NESHAP compliance program. In addition to general oversight of the program, the ESG Leader assures that periodic reports of emission monitoring data are prepared and disseminated, approves the QAPP, and conducts Technical QA Assessments and audit finding corrective actions.

Operational Health Physics Group Leader (OHPG): The OHPG Leader is responsible for Radiological Work Authorizations and Radiological Work Permits (RWA/RWP).

Radiological Work Authorization and Radiological Work Permit Program Staff: Responsible for the issuance and maintenance of these authorizations and permits. As part of these authorizations, an inventory of radiological work areas and radioisotopes stored at each area is maintained.

Technical Services Group Leader: Responsible for the operation of an on-site radiochemical laboratory, and instrumentation repair and calibration shop. In addition, is responsible for personnel dosimetry, bioassay, EH&S telemetry systems, and calibration of real time stack detector systems used for NESHAP compliance.

Representative from the Office of Assessment and Assurance: This individual plans, conducts and reports on internal independent assessments of Berkeley Lab programs including the NESHAP compliance program.

ESG NESHAP Compliance Program Staff: The ESG NESHAP Compliance Program Staff manage or perform the following responsibilities:

- Interfacing with RWA/RWP staff to determine NESHAP source inventory and monitoring requirements.

- Obtaining representative samples by identifying the sampling site, specifying sampling probes, providing sample collection services, tracking sample flow rates, tracking effluent flow rates, and maintaining/calibrating monitoring and sampling equipment.

- Interpreting analytical data, evaluating data quality, performing NESHAP dose assessments using approved EPA methods, and preparing annual reports of radioactive emissions in air.

- Supporting the ESG manager in maintaining this QAPP and coordinating EPA and DOE audits with Berkeley Staff.

- Establishing and maintaining an auditable emission source stack list and associated file.

Technical Support Vendors: The NESHAP Compliance Program contracts with commercial radiochemical laboratories and engineering consulting companies to obtain support for the analysis of stack samples, the installation and calibration of instrumentation, and the review of dose calculations.

Table 2-1 presents a matrix of emission monitoring functional elements important to quality, as described in Method 114, Section 4, versus ESG responsibilities.

Figure 2-1. Berkeley Lab NESHAP Compliance Organizational Structure

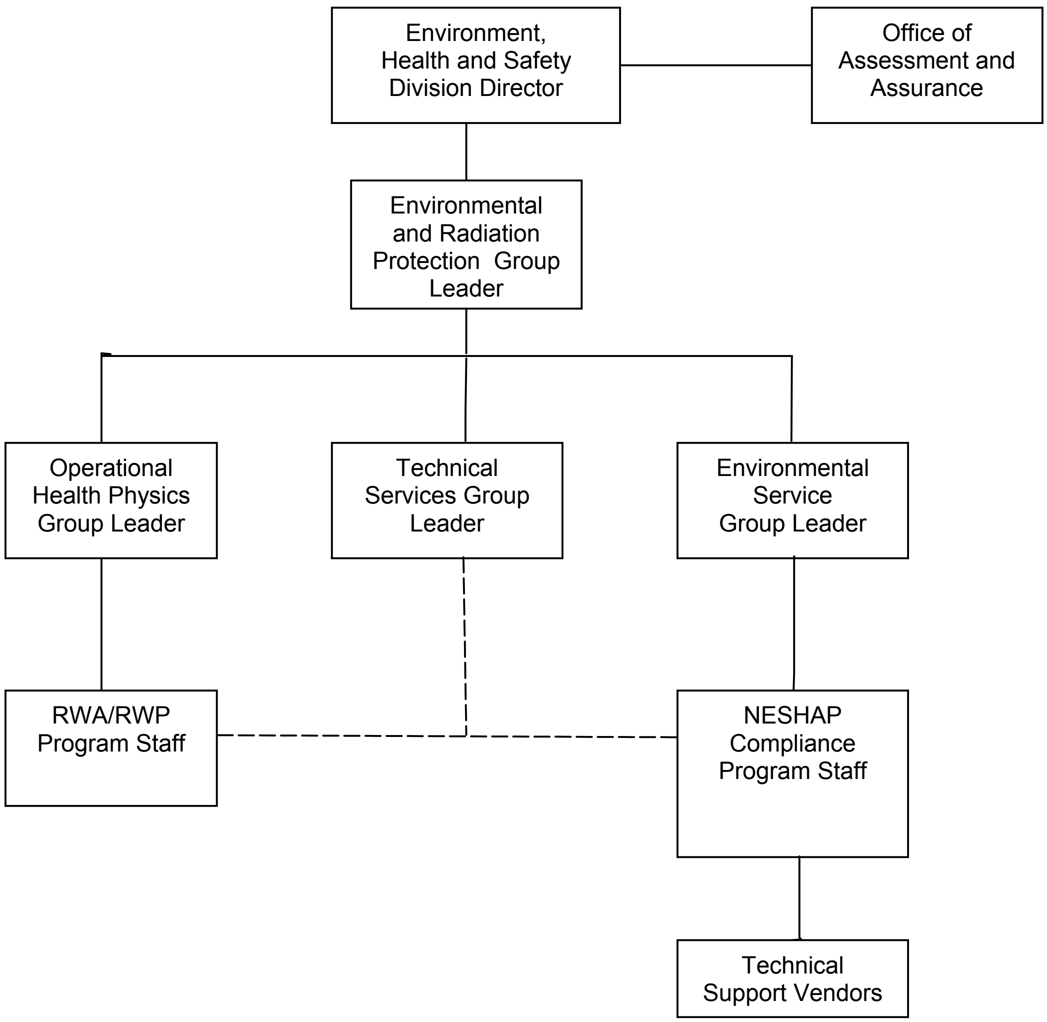

Table 2-1. NESHAP Compliance Responsibilities

Responsibilities	ERP Leader	ESG Leader	ESG NESHAP Compliance Staff	RWA/RWP Program	Technical Service Group	Technical Support Vendors	EH&S Office of Assessment and Assurance
Maintain radiation work authorization (RWA) and permit (RMP) programs				P			
Review authorized radionuclide use and inventory for NESHAP compliance			P	S			
Investigate unexpected emissions			S	P			
Identify sampling sites			P				
Select and install sampling probes			P			S	
Monitor sensitivity and calibration			P		S		
Provide design and supervision of NESHAP monitoring projects			P			S	
Collect samples			P				
Track analytical measurements			P				
Measure sample flow rate			P			S	
Measure effluent flow rate			P			S	
Review data quality (precision, accuracy, completeness of data)			P				
Assess quality control			P		S	S	
Track Samples			P				
Perform sample handling and preservation			P				
Perform internal QA audits	S	S				S	P
Perform external QA audits						P	
Perform vendor audits			P		P		
Coordinate external QA audits		P					S
Complete corrective actions	S	P	S	S		S	
Prepare periodic reports		P	S				
Prepare and maintain the QAPP		S	P				
Model Dose		S	P				
Prepare the Annual NESHAP Report		S	P				

P indicates primary organizational responsibility.
S indicates supporting organizational responsibility.

3.0 ADMINISTRATIVE CONTROLS

This section prescribes administrative controls that prevent unplanned operations (Section 3.1) and promptly respond to increases in emissions due to unplanned operations, should they occur (Section 3.2). This section satisfies the requirements of 40 CFR 61, Appendix B, Method 114, Section 4.2.

3.1 Preventive Administrative Controls

Berkeley Lab contains multiple research laboratories using radionuclides at varying frequencies and locations, depending on individual research objectives, available facilities, and operational constraints. Berkeley Lab achieves site-wide environmental compliance by centralized ESG review and oversight of research facilities, materials, equipment, and procedures. NESHAP compliance is specifically administrated by ESG environmental design reviews and by participation in the Berkeley Lab Radiological Work Authorization (RWA) and Radiological Work Permit (RWP) programs. These administrative controls are intended to prevent unexpected operations that may increase emissions.

3.1.1 Environmental Design Reviews

Each new Berkeley Lab facility design must be reviewed by the ESG for impacts on air and water quality. ESG maintains oversight of laboratory-wide programs for air quality and radiological releases, in accordance with applicable regulations and DOE Orders. Facilities Department supplies Title I, II and III design documents and specifications to the ESG for environmental compliance review.

The ESG performs NESHAP design reviews, projects the dose and defines monitoring requirements based on predetermined dose criteria (see Section 4). ESG documents verification and approval of new facility designs by administrative memoranda with accompanying comments, dose assessments, and items for resolution.

3.1.2 Radiological Work Authorization and Radiological Work Permit Programs

Radionuclide use in new or existing facilities is controlled through the RWA and RWP processes. These processes are implemented by EH&S Procedure 707*, Radiological Work Authorization Program* (Berkeley Lab, 2000e) and EH&S Procedure 705 *Radiological Work Permit Procedure* (Berkeley Lab, 2001a). Prior to radionuclide use, principal investigators must prepare an application to request the Operational Health Physics Group to issue a RWA. This application includes the name of the principal investigator, authorized personnel, work locations, radioisotopes and amounts to be used, delivery point, protective equipment, protocol summary, ALARA, and waste generation.

The Operational Health Physics Group (OHPG) provides RWA/RWP information to the ESG for evaluation and the ESG projects the dose and defines monitoring requirements based on predetermined dose criteria.

For existing facilities, the ESG initiates the appropriate monitoring procedures and ascertains monitoring equipment needs. Upon verification that the appropriate monitoring is present, the ESG coordinates with the OHPG and adds the source to the NESHAP source database file.

3.2 Response to Unplanned Operations

Unplanned operations with potential to increase emissions are prevented and detected through continuous monitoring, periodic confirmatory measurements, inventory control and evaluation of the workplace. Upon detection of unplanned increased emissions, facility personnel, ESG and OHPG respond as described below. When an unplanned operation is deemed to be reportable under the DOE Occurrence Reporting Criteria, it will be processed in accordance with Berkeley Lab procedures.

3.2.1 Response to Unplanned Continuous Monitoring Measurements

If the proximate cause of increased emissions is a spill, workers secure the operation, alert others, isolate the spill area if possible, take initial steps to minimize radiation exposure and contamination if possible, secure unfiltered ventilation, and notify the OHPG. ESG and the OHPG jointly respond to spills with potential for significantly increased emissions.

These actions assure that emissions are curtailed by the immediate termination of work accompanied with a prompt follow-up investigation by the principal investigator and facility staff, assisted by EH&S.

3.2.2 Response to Unplanned Periodic Confirmatory Measurements

Periodic confirmatory measurements are required to be performed to verify low emissions from small sources. The graded approach in the application of confirmatory measurements ranges from fixed continuous confirmatory sampling to administrative control of radionuclide inventory.

ESG inspects and identifies data (by database query) that exceeds emission criteria. ESG verifies that release point emissions are less than the 0.1 mrem/year threshold, and are consistent with release modeling assumptions. Minor emission increases, consistent with 40 CFR 61 requirements and the Berkeley Lab monitoring strategy (Berkeley Lab, 1992), may only warrant continued observation. Significant emission increases may require modification of the monitoring regime, amendment of the RWA/RWP or reduction/termination of the activity pending evaluation.

3.2.3 Response to Unplanned Radionuclide Inventory Control Results

Procurement of radioactive material is reviewed by EH&S prior to action by the purchasing representative. The OHPG receives all Berkeley Lab radionuclide shipments, in accordance with the EH&S Manual, PUB-3000 (Berkeley Lab, 2001f), and conducts a survey of the shipment, including a determination if the investigator is authorized to receive the material. Radioactive material is not forwarded to the investigator if the survey indicates inappropriate contamination or radiation levels, or if the activity exceeds the investigator's permitted limits. Correct delivery is verified by requiring the recipient to sign a receipt for acceptance of radioactive material.

When required, the discrepancies are processed in accordance with Berkeley Lab procedures for occurrence reporting and processing. The Radiation Control Manager notifies ESG personnel of such incidents, who then determine if environmental monitoring is required (Berkeley Lab, 2001h).

3.2.4 Response to Unplanned Radiological Survey Results

Routine surveys may detect unexpected radiological conditions that could increase emissions. OHPG personnel periodically tour facilities with radionuclide emissions. Principal investigators and facility workers survey the workplace in accordance with their approved radionuclide authorizations, and *PUB-3000*. The OHPG conducts frequent surveys of workplaces in accordance with 10 CFR 835 (DOE, 2000), verifying compliance with RWA/RWP provisions and occupational radiation protection requirements.

OHPG personnel, research facility management, and any worker through their supervisor, are authorized to stop noncompliant activities including unauthorized activities which may increase emissions. Upon termination of radionuclide work for cause, work is not resumed until radiological control is reestablished and after approval of the principal investigator and the OHPG.

OHPG personnel notify the OHP group leader and the Radiation Control Manager (who is also the ERP group leader) of incidents involving actual or potential release of radionuclides to the environment. The Radiation Control Manager notifies ESG personnel of such incidents, who then determine if environmental monitoring is required (Berkeley Lab, 2001h).

4.0 STACK MONITORING, SAMPLE COLLECTION AND ANALYSIS

This section contains a general description of the monitoring, sample collection, and analysis practices in use at Berkeley Lab for the NESHAP Compliance Program and addresses the requirements of 40 CFR 61, Appendix B, Method 114, paragraph 4.3. Detailed information on monitoring and sampling is contained in the procedures listed in Section 11 (References) and in other documents listed in the Appendices to this QAPP. This section discusses:

- The NESHAP monitoring and sampling sites and the rationale for their selection (Section 4.1),
- Sampling probes and representativeness of samples (Section 4.2),
- Sample collection systems by isotope type (Section 4.3),
- Laboratory analysis procedures (Section 4.4),
- Sample flow rate measurement systems and procedures (Section 4.5), and
- Effluent flow rate measurement systems and practices (Section 4.6).

Information on those stacks which require radionuclide emission measurements in accordance with the requirements of 40 CFR 61.93(b) is intended to be complete and to demonstrate compliance with the NESHAP standard. Any specific deviations from the requirements are identified, justified, documented, and do not result in a significant impact on the representativeness, precision or accuracy of the measurement results. These deviations are discussed in detail in the documents referenced in the respective Appendices of this QAPP.

Those stacks that require periodic confirmatory measurement are also addressed in this QAPP. Berkeley Lab generally performs continuous sampling with off-line analyses in lieu of periodic sampling and analysis or implements inventory control in accord with the NESHAP Compliance Strategy (Table 4-1). However, at several facilities that require only periodic sampling, Berkeley Lab has chosen to do more and operates continuous real-time monitoring systems. The operation of continuous real time monitoring systems provides the required stack measurements and also generates prompt stack emission data for use by facility staff in reducing their emissions. Both the continuous sampling and the real-time monitoring systems that are operated for periodic confirmatory sampling applications are referenced in Appendix B and C. These methods meet or exceed the requirement of the sampling strategy in the Berkeley Lab NESHAP Compliance Plan (Berkeley Lab, 1992) presented to EPA and DOE during the meeting of February 13, 1992. Table 4-1 summarizes the current NESHAP Compliance Strategy

Table 4-1 NESHAP Compliance Strategy

Annual Effective Dose Equivalent (AEDE) Criteria (mrem/y)	**NESHAP Sampling Required**	**Category**	**Minimum Compliance Monitoring Performed by Berkeley Lab**
AEDE ≥ 10.0	Non-compliant	Non-compliant	Reduce or relocate source term and re-evaluate prior to authorization.
10.0 > AEDE ≥ 0.1	Continuous	I	• Continuous sampling with weekly analysis required • Continuous real-time monitoring with telemetry for nuclides with half-lives < 100 h • EPA Application to Construct or Modify Required.
0.1 > AEDE ≥ 0.05	Periodic Confirmatory	II	Continuous sampling with weekly analysis.
0.05 > AEDE ≥ 0.01	Periodic Confirmatory	III	Continuous sampling with monthly analysis.
0.01 > AEDE ≥ 0.001	Periodic Confirmatory	IV	Annual sampling during project activity is required. (In lieu of annual sampling, continuous sampling with monthly analysis is performed.)
AEDE < 0.001	Periodic Confirmatory	V	Inventory controlled by RWA/RWP and periodic evaluation. No monitoring required.

4.1 Sampling Sites And Rationale For Selection

Sampling and monitoring sites for particulate radioactive effluents were generally selected in accordance with the guidance of ANSI N13.1 (ANSI, 1969) and the requirements of 40 CFR 60, Appendix A, Methods 1 and 1A, at appropriate distances from stack discharge, bends, or other flow discontinuities. Deviations from the Standard are explained in the documents cited in the Appendix for each respective system. Sampling and monitoring sites for gaseous species of air activation products from Berkeley Lab accelerators and for tritium were not specifically selected in accordance with the referenced criteria as these species are essentially uniformly distributed in the effluent streams.

4.1.1 Sites Requiring Continuous Sampling or Monitoring (Category I)

Any Berkeley Lab stack with the potential for releasing airborne radioactive effluents which could result in an offsite effective dose equivalent equal to or in excess of 1% of the 40 CFR 61.93(b)(4)(i) Standard (i.e., equal to or in excess of 0.1 mrem/yr) is equipped with continuous, real-time monitoring systems or continuous sampling systems. Stack and sample flow rates are logged.

Release points that require continuous monitoring have high linear effluent flow rates such that laminar flow is not possible. Turbulent flow (Re>2100) exists in these stacks and provides greater mixing of the effluent stream with velocities more nearly uniform across the diameter of the ducts and stacks. The importance of the specific positioning and sizing of the sampling probe is, therefore, less critical as long as a position of average flow is selected and as long as there are no gross flow discontinuities.

Building 75 is the only facility that requires continuous monitoring. Detailed information on the monitoring system is referenced in Appendix A of this QAPP.

4.1.2 Sites Requiring Periodic Confirmatory Measurement (Category II-V)

Berkeley Lab stacks that do not have the potential for approaching the 0.1 mrem/yr criterion are required to be sampled periodically to confirm low emission rates. However, in accordance with the NESHAP Compliance Strategy summarized below, Berkeley Lab performs continuous real-time monitoring or continuous sampling with off-line analysis for those sites that only require periodic confirmatory sampling or implements inventory control in accord with the NESHAP Compliance Strategy. The current list of locations that require periodic confirmatory sampling is contained in the ESG NESHAP source file and is maintained by the NESHAP Compliance Program. Detailed technical information on the sampling and analysis methods used to comply with periodic confirmatory stack sampling requirements are documented in EH&S Procedure 280 and 290. The following is a brief description of the NESHAP Compliance Strategy for a graded approach to periodic confirmatory measurements at Berkeley Lab. These specifications represent the minimum requirements and, in many instances, Berkeley Lab performs more rigorous and comprehensive measurements.

- Stacks which present potential offsite annual effective dose equivalent of between 0.05 and 0.1 mrem (Category II) are required to be sampled continuously with probes designed to sample isokinetically (for particulate) at a fixed flow rate. Sample collection media are required to be changed with a minimum frequency of once per week.

- Stacks with the potential for an offsite annual effective dose equivalent between 0.01 and 0.05 mrem (Category III) are required to be sampled continuously with probes designed to sample isokinetically (for particulate) at a fixed flow rate. Sample collection media are required to be changed at a minimum frequency of once per month.

- Stacks with the potential for an offsite annual effective dose equivalent between 0.01 and 0.001 mrem (Category IV) are required to be sampled at a minimum frequency of once per year during a typical two week work cycle using a probe designed to sample isokinetically (for particulate) at a fixed sample flow rate.

- Stacks with the potential for an offsite annual effective dose equivalent of less than 0.001 mrem (Category V) are not required to be sampled, but the associated radionuclide use is reviewed annually to verify that total nuclide use is still reflective of less than this calculated effective dose equivalent.

Most stacks requiring periodic confirmatory measurement have turbulent flow (Re>2100), where probe position and size are less critical. Periodic confirmatory stack sampling sites are established at locations of average flow in the effluent stream and are sampled at near-isokinetic flow rates.

4.2 Sampling Probes and Representativeness of Samples

The following sections describe the sampling probe designs and isokinetic characteristics of the sampling systems. Isokinetic sample probes are generally constructed in accordance with the guidance of ANSI N13.1 (ANSI, 1969) based on the duct or stack size and effluent flow velocity profile.

4.2.1 Stack Requiring Continuous Real-Time Monitoring Systems

Continuous, real-time monitoring is required for Category I release points with radionuclide half-lives less than 100 hours. At Berkeley Lab, there are no Category I release points with radionuclide half-lives less than 100 hours. However, Berkeley Lab does perform continuous real-time monitoring at Buildings 56, 70A, 75 and 88. These real-time monitoring systems exceed the NESHAP compliance requirements for these release points. Design details for these systems are referenced in Appendix B.

4.2.2 Stacks Requiring Continuous Sampling

Particulate Sampling: Based on historical stack emission data and the NESHAP Compliance Strategy, Berkeley Lab does not have any Category I release points that require continuous particulate sampling or monitoring.

Gaseous Sampling: Building 75 (room 103) is the only location that requires a continuous gaseous sampling system and it is described in Section 4.3.1. Sampling of the gaseous effluent is expected to be representative within the accuracy of the sampling equipment (Berkeley Lab, 1994b).

4.2.3 Stacks Requiring Periodic Confirmatory Measurement

The sampling probes for those stacks that require periodic confirmatory measurement were designed to provide near-isokinetic sampling at a point of average flow across the stack cross-section and at the median flow rate expected from the stack. The effluent flow rate from many of these stacks varies dependent on the number of fans in use. The probes were designed to sample at a fixed rate at the point of the average anticipated flow rate. Many of these stacks are also equipped with HEPA filters upstream of the sampling sites, which reduce the average size of particulate species these systems collect. This serves to minimize the impact of any anisokinetic flow variations. Design details of these probes are referenced in Appendix B and C.

4.3 Sample Collection Systems by Isotope Type

This section discusses the sample collection systems that are required for NESHAP compliance, including systems employed for sites requiring continuous monitoring and systems for sites requiring only periodic confirmatory measurement.

4.3.1 Stack Requiring Continuous Real Time Monitoring

At Berkeley Lab, there are no Category I release points with radionuclide half-lives less than 100 hours. However, Berkeley Lab does perform continuous real-time monitoring at Buildings 56 (positron emitters), 70A (alpha emitters), 75 (tritium) and 88 (positron emitters). These real-time monitoring systems exceed the NESHAP compliance requirements for these release points. Design details for these systems are referenced in Appendix B.

4.3.2 Stacks Requiring Continuous Sampling

Building 75-103 Sample Collection System

The Building 75 room 103 stack releases tritium, as tritiated water (HTO) and tritiated hydrogen gas (HT). The continuous sampling system provides tritium speciation which allows total tritium (Total T) and HTO samples to be separately collected onto two glass columns filled with indicator silica gel. Sample flow is totaled with a gas flow meter and controlled by a needle valve, rotometer, and a positive displacement diaphragm gas flow meter. The sample lines are heat traced to assure no loss or delay of sample by condensation. Sample columns are exchanged weekly and analyzed by a qualified vendor laboratory. The technical specifications for the Building 75 Room 103 stack sampling and monitoring systems are referenced in Appendix A.

4.3.3 Stacks Requiring Periodic Confirmatory Measurement

Berkeley lab conducts continuous sample collection or real-time continuous monitoring in lieu of the less rigorous periodic confirmatory sample collection that is required for NESHAP compliance. Details on these systems are referenced in Appendix B and C. For those stacks that require periodic confirmatory sampling, air particulate (transuranics, actinides, and solid fission products) are collected with particulate sampling filters. Iodines are collected with a standard charcoal cartridge. Tritiated water is collected with a column filled with indicator silica gel. Gaseous carbon is collected in bubblers. Gaseous positron emitters are continuously monitored in real-time by use of flow-through gas proportional counters (Berkeley Lab, 1994b). These sample collection systems were initially calibrated by their vendors and sample flow is recalibrated annually. The completed initial and periodic calibration documentation is maintained in the ESG NESHAP file. Annual instrument calibrations are performed as described in the NESHAP Procedures referenced in this QAPP.

4.4 Laboratory Analysis Procedures

All continuously sampled emission sources with the potential to equal or exceed 0.1 mrem/year are analyzed using procedures conforming to 40 CFR 61, Appendix B, Method 114. Alternative screening methods may be used to initially characterize the sample.

Sources for radioanalytical procedures include EPA methods, ASTM Standard Methods, the EML Procedures Manual (HASL-300), the Radiological and Environmental Sciences Laboratory (RESL) Procedures Manual and the Eastern Environmental Radiation Facility Radiochemical Procedures Manual. Specifications for the analytical methods utilized in the NESHAP Compliance Program are included in the Statement of Work for Analytical Services (LLNL, 2000).

4.4.1 Frequency of Analysis

The minimum analysis frequency is determined by the release point category under the NESHAP Compliance Strategy (Berkeley Lab, 1992). Stacks with the potential for an offsite effective dose equivalent of less than 0.001 mrem are not required to be sampled; radionuclide use is reviewed annually to verify low emissions. Minimum analysis frequencies are summarized in Table 4-1.

4.4.2 Calibration and Verification Procedures and Frequency

Radioanalytical instruments are calibrated periodically as required and documented in the analytical laboratory operating procedures. Instruments are immediately calibrated following quality control discrepancies, instrument repair or adjustment, or procedural changes affecting instrument response. Additionally, instrument performance checks are performed on either batch or periodic bases to confirm the annual calibrations. These tests are delineated in laboratory procedures.

Radioactive standards are obtained from commercial vendors. All sources are traceable to the National Institute of Standards and Technology (NIST). Calibration standards are prepared to closely reflect the actual sample counting configuration (LLNL, 2000).

4.5 Sample Flow Rate Measurement Systems and Procedures

Sample flow rate measurement systems for release points requiring continuous sampling or periodic confirmatory sampling (as required per the NESHAP Compliance Strategy) are described below. The frequency of flow integration or flow-rate measurement meets or exceeds the frequency of radiological measurement.

4.5.1 Stacks Requiring Continuous Real-Time Monitoring

Based on historical emission data and the NESHAP Compliance Strategy, Berkeley Lab is not required to operate any continuous real-time monitoring systems. However, Berkeley Lab does perform continuous real-time monitoring at Buildings 56, 70A, 75 and 88.

4.5.2 Stacks Requiring Continuous Sampling

For the Building 75 continuous tritium sampling system, the sample flow rate instrumentation consists of a mass flow controller and digital meter. The mass flow controller was initially calibrated by their manufacturers. The records of initial calibrations are maintained in the ESG NESHAP file. Annual recalibrations are performed in accordance with EH&S Procedures or by Berkeley Lab approved qualified contractors using standard procedures.

Berkeley Lab has chosen also to operate a continuous real-time tritium monitoring system at Building 75, Room 103, in order to provide a back-up system to the continuous sampling system. The system is composed of ion counting chambers, valves, mass flow meters, pumps, and data collection systems, as detailed in Appendices A and B. Records of initial calibration and annual recalibration are maintained in the ESG NESHAP file.

4.5.3 Stacks Requiring Periodic Confirmatory Measurement

For the stacks that require periodic confirmatory sampling, sample flow rate measurement systems and procedures are detailed in EH&S Procedure 280 and within documents listed in Appendix B and C. Generally, the systems consist of a continuous air volume totalizer, a valve and rotometer (for tritium, carbon, and sulfur), a flow control valve (for particulate and iodine), and a rotary carbon vane pump. Real-time monitoring sample flow rate measurement systems used for periodic confirmatory sampling applications are also referenced in EH&S Procedure 290, and within Appendix B. Berkeley Lab has chosen to operate real-time monitoring systems at Buildings 56, 70A, and 88 to comply with the periodic confirmatory sampling requirements.

Sample flow rates were initially calibrated at the factory. All records of initial factory calibrations are maintained in the ESG NESHAP file. Annual recalibrations of sample flow are performed prior to periodic sampling in accordance with EH&S Procedures or by qualified contractors.

4.6 Effluent Flow Rate Measurement Systems and Practices

Stack effluent flow rate measurement systems for release points requiring continuous sampling or periodic confirmatory sampling (as required per the NESHAP Compliance Strategy) are described below. The installed systems are demonstrated to meet the requirements of 40 CFR 60, Appendix A, Method 2 or 2A, as appropriate, or by EPA-approved methods involving initial qualification per 40 CFR 52, and annual recalibration. The frequency of flow integration or flow-rate measurement meets or exceeds the frequency of radiological measurement.

4.6.1 Stacks Requiring Continuous Real-time Monitoring

Based on historical emission data and the NESHAP Compliance Strategy, Berkeley Lab is not required to operate any continuous real-time monitoring systems. However, Berkeley Lab does perform continuous real-time monitoring at Buildings 56, 70A, 75, and 88.

4.6.2 Stacks Requiring Continuous Sampling

The Building 75, room 103, tritium stack effluent flow rate measurement system consists of two mass flow sensors installed in an "X" pattern in the stack and a mass flow computer/transmitter. Effluent flow rates were initially calibrated in place, after installation. Annual recalibrations are performed in accordance with EH&S Procedures or by a contract vendor. The records of the initial and annual calibrations are maintained in the ESG NESHAP file.

4.6.3 Stacks Requiring Periodic Confirmatory Sampling

Effluent flow rates from stacks requiring periodic sampling are initially and annually calibrated in accordance with EH&S Procedures or by a contract vendor. Thermal anemometry is typically used to measure the flow velocity profile, generally in accord with the requirements of 40 CFR 60, Appendix A, Methods 1 & 2. Records of effluent flow rate measurements and flow measurement instrument calibration are maintained in the ESG NESHAP file.

Berkeley Lab has chosen to operate real-time monitoring systems at Buildings 56, 70A, and 88 to comply with periodic confirmatory sampling requirements. Real-time monitoring effluent flow rate measurement systems used for periodic confirmatory sampling applications are also initially and annually calibrated. Records of effluent flow rate measurements and flow measurement instrument calibration are maintained in the ESG NESHAP file.

5.0 DATA QUALITY OBJECTIVES

This section discusses the data quality objectives for NESHAP stack monitoring and satisfies the requirements of 40 CFR 61, Appendix B, Method 114, paragraph 4.4.

ESG has established data quality objectives (DQO) for environmental compliance measurements (including NESHAP emission monitoring); accuracy, precision, completeness, comparability and representativeness. ESG DQOs and the process for assessing data quality are documented in Environmental Health and Safety Procedure No. 252, *Data Quality Objectives and Assessment* **(**Berkeley Lab, 1997b).

Data quality is assessed by the analytical laboratory personnel per batch of results in accordance with analytical laboratory procedures. Then ESG personnel assess the data quality of each analytical batch, before the data is authenticated and incorporated into the ESG databases. The DQOs are primarily based on analytical laboratory QC limits and all laboratories utilized by ESG are required to use pre-approved and documented QC procedures which meet or exceed QC performance standards defined in the *Statement of Work for Analytical Services* (LLNL, 2000) or equivalent specifications document. In addition, all NESHAP radiological analyses are performed under a laboratory quality assurance program that meets the requirements of DOE Order 5700.6C *Quality Assurance Program Implementation Guide* (DOE, 1991b) or the American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME*) Nuclear Quality Assurance Program NQA-1-1989* (ANSI/ASME, 1989).

6.0 QUALITY CONTROL

This section describes the radioanalytical quality control (QC) program as applied to NESHAP emission measurements, pursuant to 40 CFR 61, Appendix B, Method 114, paragraph 4.5. Appendix D describes the number and frequency of use of replicate, spike, split, and blank samples.

6.1 Evaluation and Tracking of Emission Data Quality

QAPP Section 5 discusses NESHAP compliance data quality objectives and assessment.

6.1.1 Radioanalytical QC Testing

The analytical laboratory employs laboratory control samples. sample blanks and duplicates samples as appropriate for each radioanalytical system. These QC data are compared to established control limits in order to verify acceptable performance of the measurement system.

6.1.2 Sampling and Continuous Monitoring QC Testing

ESG or a contract vendor performs functional checks of air flow measurement instruments (flow meters, anemometers) prior to use and records the results associated with the instrument. Results are compared with a $\pm$10% accuracy criterion about the calibrated mean.

Continuous monitoring systems are tested for general operating condition, background response and source response in accordance with ESG or contract vendor procedures.

6.1.3 Quality Control Corrective Actions

If a QC control limit is exceeded, the disparity is evaluated per EH&S Procedure 252 *Data Quality Objectives and Assessment* (Berkeley Lab, 1997b). When the disparity is deemed significant, EH&S Procedure 208 *Nonconformance and Corrective Action Reporting* (Berkeley Lab, 2001g) is implemented. This procedure identifies and documents quality problems, determines the underlying cause, and when necessary implements corrective action to prevent reoccurrence of the nonconformance

6.2 Quality Control Samples

The analytical laboratory employs several types of quality control samples. Appendix D provides the minimum number and frequency of quality control sample tests and the radioanalytical measurements tested. The QC sample types and their uses are described below.

QC Blank: Laboratory blank samples and field blank samples are analyzed with each analytical batch to monitor laboratory and total method contamination, respectively.

QC Spike or Standard: Laboratory reference samples (matrix standard, reagent spike, etc.) are analyzed with each analytical batch. Comparison of the measured activity with the known spiked activity yields information on method or instrument accuracy.

Interlaboratory Comparison Samples: These are samples prepared by EPA, DOE, or a vendor, and contain quantities of radioactive material not revealed to the analytical laboratory. This data is used to assess the accuracy of the laboratory measurements relative to the accuracy DQO.

QC Blind: Blind intercomparison samples are prepared by an independent laboratory and submitted by ESG to the analytical laboratory for analysis. The blind sample is indistinguishable from a field sample and contains a quantity of radioactive material not revealed to the analysts. The blind sample is introduced into the normal analytical routine and the results assessed.

QC Duplicates and Splits: Duplicate or split samples are analyzed to assess analytical precision. Tests for significance are performed by calculating the Relative Error Ratio and/or Relative Percent Difference for the sample/split data pairs.

7.0 SAMPLE TRACKING

This section describes the ESG analytical sample and data tracking program as applied to NESHAP emission measurements, pursuant to 40 CFR 61, Appendix B, Method 114, paragraph 4.6.

Section 7.1 describes the identification of samples. Section 7.2 discusses the tracking of sample data. Section 7.3 presents sample handling and preservation procedures during collection, storage and analysis.

7.1 Sample Tracking

NESHAP samples are systematically tracked during sampling and analysis using a Sample Collection form and a Chain-of-Custody form. The Sample Collection form is used by the sample collection staff to record field notes regarding collected samples. The Chain of Custody form follows the sample from the point of collection to final disposition. Sample tracking is implemented using EH&S Procedure 268, *Environmental Sample Tracking and Data Management,* (Berkeley Lab, 2000b).

7.2 Data Tracking

Records of analysis are retained for 75 years, including notebooks, data from analytical instrumentation, and associated quality control data. ESG records are also retained for 75 years, including all Chain-of-Custody forms, Sample Collection forms, sample logbooks, and monitor telemetry. These data files may be computer-based. Records are periodically archived for long-term storage. A database management system allows computerized search and retrieval of selected elements of the data set. The following data is recorded for each sample:

- Sample identification
- Sample matrix
- Date of analysis
- Radioanalytical method
- Quality control data
- Analyte results
- Analytical laboratory

7.3 Sample Handling and Preservation

All sample media require a minimum of preservation steps for sample integrity. EH&S Procedure 280 and 268 specifies required sample handling and preservation.

8.0 PERIODIC AUDITS

This section describes auditing at Berkeley Lab as it applies to the NESHAP Compliance Program. This section satisfies 40 CFR 61, Appendix B, Method 114, paragraph 4.7.

8.1 Internal Audits

Internal auditing of the NESHAP Compliance Program is carried out by performing technical QA assessments and independent assessments. These two internal auditing practices are described below.

8.1.1 Technical QA Assessments

In order to monitor compliance with the NESHAP QAPP, evaluate work processes, and improve program performance, technical QA assessments are performed on the NESHAP Compliance Program. These assessments are routinely performed during the year in scheduled staff meetings between the Group Leaders and the ESG NESHAP Compliance Program personnel.

Berkeley Lab also performs structured audits of all radioanalytical service labs that support the NESHAP Compliance Program.

8.1.2 Internal Independent Assessments

The Office of Assessment and Assurance (OAA) within the EH&S Division conducts internal independent assessments of the NESHAP Compliance Program. These independent assessments are conducted periodically to evaluate overall compliance with the QAPP and the Berkeley Lab Operational and Assurance Plan by reviewing the NESHAP Compliance Program organization, process management, and the technical QA assessments.

8.2 External Audits

Berkeley Lab is operated by the University of California under contract to the U.S. Department of Energy. The operating contract for Berkeley Lab, Appendix F, Part A, Section I, Item 5, delegates oversight authority to DOE headquarters, field office, and site office personnel.

DOE oversight of Berkeley Lab programs is performed by DOE EH-24 personnel who periodically audit the NESHAP Program and by DOE Berkeley Site Office personnel under Berkeley Lab's Operational Awareness Program, which includes continuous interaction and oversight by DOE. Routine operational awareness activities include field orientations, meetings, audits, workshops, document and information system reviews, and day-to-day communications. The DOE criteria for performance evaluation include federal, state, and local regulations with general applicability to DOE facilities and DOE orders and directives made binding on the University in the contract.

EPA Region IX also conducts external audits of the NESHAP monitoring program, as Berkeley Lab is a DOE facility whose emissions are regulated under 40 CFR 61, Subpart H.

8.3 Independent Audits

LBNL management may also elect to institute periodic independent assessments utilizing auditors from outside organizations to monitor compliance with the NESHAP quality assurance program requirements specified in 40 CFR 61, Appendix B, Method 114, Section 4 under the umbrella of the LBNL Operating and Assurance Program (OAP). When LBNL management, at its sole discretion, elects to institute such an independent assessment process, the assessment should generally be conducted in accordance with written procedures; address activities conducted in support of compliance with the requirements of 40 CFR 61.95, for maintenance of documentation sufficient to allow an independent auditor to verify the accuracy of determinations made concerning compliance with the standard; be performed to a written checklist; and be documented in a written report.

9.0 CORRECTIVE ACTIONS

This section describes corrective actions taken for quality findings during reviews of the NESHAP emission measurement program, when corrective actions are needed, and who is responsible for corrective actions. Corrective actions for any audit finding that affects regulatory compliance are tracked using the Laboratory Corrective Action Tracking System (LCATS) (Berkeley Lab, 2000d). Corrective actions for minor audit findings, such as suggested improvements or observations, may also be tracked in LCATS or they may be tracked internally (within ESG), as appropriate.

This section satisfies 40 CFR 61, Appendix B, Method 114, paragraph 4.8 and describes actions taken in response to quality audit findings; however, other measures may also be interpreted as "corrective actions." EH&S Procedure 208 *Nonconformance and Corrective Action Reporting* (Berkeley Lab, 2001g) is implemented as necessary.

9.1 Internal Audit Corrective Actions

Corrective actions for internal audits are needed when audit plan acceptance criteria are not met. These acceptance criteria may be specific to the NESHAP emission measurement program, such as analytical procedure compliance or 40 CFR 61 requirements. Broader programmatic findings may also affect emissions monitoring, such as recordkeeping practices.

Responses to technical QA assessment findings are forwarded to the responsible EH&S Group Leaders and include immediate corrective actions to correct the deficiency, cause identification, actions taken to prevent recurrence, and data for DOE occurrence reporting, if required. The responsible EH&S Group Leader independently evaluates the response.

Responses to internal independent assessments are forwarded to the OAA and the responsible EH&S Group Leader. When concurrence is obtained on internal independent assessment deficiencies and corrective action plans, the information is incorporated into LCATS, as described above.

9.2 External Audit Corrective Actions

Corrective actions for external audits are needed when the auditing organization tracks a finding for appropriate correction and closure. Laboratory management also considers corrective actions for RWA/RWP minor observations and quality improvements noted during external audits (Berkeley Lab, 2000a and 2001e).

The NESHAP Program staff take corrective actions as appropriate, including alerting responsible management, OAA staff and other involved personnel, removing nonconforming items, securing noncompliant activities, and preparing DOE occurrence reports, if required. External audit corrective actions are also tracked through LCATS.

10.0 PERIODIC REPORTS

This section describes the NESHAP emission measurement data reporting program. Section 10.1 describes the assessment of data. This section satisfies 40 CFR 61, Appendix B, Method 114, paragraph 4.9.

10.1 Data Reporting

Reports of NESHAP emission measurement data are produced annually, as required by Berkeley Lab policies, DOE Orders and programs, and EPA regulations. Annual reporting is preceded by ESG assessment of data quality, as discussed in ESG Procedure 252, *Data Quality Objectives and Assessment* (Berkeley Lab, 1997b), and data interpretation. The authenticated and interpreted data sets are utilized by the NESHAP Compliance Program Staff for preparing the annual reports that summarize the NESHAP emission monitoring data for the calendar year.

40 CFR 61.94 requires submittal of a NESHAP annual report to EPA, which documents dose received by the public based on the emission measurement program data. The contents of the report are specified in 40 CFR 61.94.

ESG also submits an annual *Site Environmental Report* (SER) to DOE for each calendar year. The SER summarizes laboratory environmental compliance issues, and presents non-radiological and radiological environmental monitoring methods and results, including NESHAP emission monitoring data and dose assessments.

11.0 REFERENCES

American National Standards Institute (ANSI, 1969), ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, ANSI, New York, NY.

American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME, 1989*), Nuclear Quality Assurance Program NQA-1-1989.*

Department of Energy (DOE, 1986), DOE Order 5482.1B, *Environment, Safety, and Health Appraisal Program*, USDOE, Washington, DC.

Department of Energy (DOE, 1991a), DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, USDOE, Washington, DC.

Department of Energy (DOE, 1991b), DOE Order 5700.6C, *Quality Assurance Program Implementation Guide,* USDOE, Washington, DC.

Department of Energy (DOE, 2000), 10 CFR 835, *Radiation Protection for Occupational Workers*, USDOE, Washington, DC.

Environmental Protection Agency (EPA, 1977), EPA-600/7-77-088, *Handbook for Analytical Quality Control in Radioanalytical Laboratories*, USEPA, Washington, DC.

Environmental Protection Agency (EPA, 2000), *Radionuclide National Emission Standard for Hazardous Air Pollutants* (NESHAP), 40 CFR 61 Subpart H, USEPA, Washington, DC.

HI-Q Environmental Products Company, (Hi-Q, 2001a), Hi-Q Procedure, *Performance Verification of Installed Continuous Volumetric Flow Rate Measurement Systems*, San Diego, CA.

HI-Q Environmental Products Company, (Hi-Q, 2001b), Hi-Q Procedure, *Stack Velocity and Volumetric Effluent Flow Rate Determinations*, San Diego, CA.

HI-Q Environmental Products Company, (Hi-Q, 2001c), Hi-Q Procedure, *Sampler Flow Rate Determination*, San Diego, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 1992), Memorandum C. Allen to Distribution, April 7, 1992, *NESHAPs Compliance Plan (Stack Monitoring); February 13, 1992 Meeting with EPA Region Nine*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 1994a), *Facilities Department Procurement Specifications; NESHAPs Projects 1A/1B, 2, and 3*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 1997), EH&S Procedure No. 252, *Data Quality Objectives and Assessment*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2000a), EH&S Procedure 280, *Stack Sampling Procedure*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2000b), EH&S Procedure 268, *Environmental Sample Tracking and Data Management Procedure*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2000c), EH&S Procedure 290*,* *Continuous Real-Time Stack Monitoring Systems*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2000d), *Operating and Assurance Plan* (OAP), PUB-3111, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2000e), EH&S Procedure 707 Rev. 3, *Radiological Work Authorization Program*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001a), EH&S Procedure 705 *Radiological Work Permit Procedure* Rev. 2, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001b), EH&S Procedure 353.3, *Calibration and Performance Testing of B75-131 Tritium Monitoring Station*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001c), EH&S Procedure 353.1, *Calibration and Performance Testing of Continuous Air Monitors*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001d), EH&S Procedure 353.2, *Calibration and Functional Check of Real-Time Positron Stack Monitors*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001e), *Radionuclide Air Emission Annual Report, (Subpart H of 40 CFR 61), Calendar Year 1996*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001f), *EH&S Manual, PUB-3000,* Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001g), EH&S Procedure No. 208, *Nonconformance and Correction Action Reporting*, Berkeley, CA.

Lawrence Berkeley National Laboratory (Berkeley Lab, 2001h), EH&S Procedure No. 700, *Hazmat Response to Radiological Incidents*, Berkeley, CA.

Lawrence Livermore National Laboratory (LLNL, 2000*), Statement of Work for Analytical Services in Support of Lawrence Livermore National Laboratory* *and Lawrence Berkeley National Laboratory,* Revised December 15, 2000.

APPENDIX A.
CATEGORY I STACK
EMISSION SAMPLING AND REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDING 75, ROOM 103

System Summary

Document ID	Title	Date	Content Summary	EH&S Location
Project 2/3 Submittal 7	Detailed Technical Specifications	11/5/93	Description of detection systems and equipment drawings.	75B-113
Project 2/3 Submittal 2, 2A	Building 75-103 Continuous HT and HTO Collection System	1/3/94	Description of tritium sample collection/detection system for B75-103.	75B-113
Project 2/3 Submittal 15	Quality Assurance Project Plan for Instrument Installation	7/19/94	Hi-Q QAPP in tabular form for Project 2/3 sources.	75B-113
NTLF RTMS Detector Modification	Reconfiguration of the NTLF RTMS Detectors	12/10/99	Design drawings of the NTLF RTMS	75B-113

Sample Site Location

Document ID	Title	Date	Content Summary	EH&S Location
Project 2/3 Submittal 17B	Installation Drawings	5/9/94	Mechanical details and instrumentation drawings.	75B-113

Effluent Flow Rate Measurement Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 18	Response to Berkeley Lab Specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113
Project 2/3 Submittal 15	USEPA Method 2 Determination of Volumetric Flow Rate	12/15/93	EPA Method 2 stack flow rate measurement procedures provided by vendor.	75B-113

APPENDIX A.
CATEGORY I STACK
EMISSION SAMPLING AND REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDING 75, ROOM 103 (continued)

Sample Flow Rate Measurement Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 18	Response to Berkeley Lab Specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113
Project 2/3 Submittal 13	Sample Extraction Nozzles, Mass-Flow Sensor Flanges, Calibration Ports, Sample Return Ports and Flanges	12/3/93	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113

Sample Probe Design

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 13	Sample extraction nozzles, mass-flow sensor flanges, calibration/sample return ports/flanges	12/3/93	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113

Sample Collection Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 2, 2A	Building 75-103 Continuous HT and HTO Collection System	1/3/94	Description of tritium sample collection/detection system for B75-103.	75B-113

APPENDIX A.
CATEGORY I STACK
EMISSION SAMPLING AND REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDING 75, ROOM 103 (continued)

Sample Representativeness

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 11B	Procedure and Calculations for Particle Loss	3/25/94	Sample line particle loss test methods and results per NUREG/GR-0006.	75B-113

Design Drawings

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 22A	ID Tags for New Equipment	6/16/94	Vendor designs for equipment cabinet tags.	75B-113
Project 2/3 Submittal 21A	Wiring, Wiring B	5/25/94	Wiring diagrams for B75-131, 127EH systems.	75B-113
Project 2/3 Submittal 17	Instrument Floor Plan Layout	12/15/93	Floor plans presenting equipment cabinet layout.	75B-113
Project 2/3 Submittal 16	Preliminary Wiring Schematics, Bldg. 75	4/6/94	Equipment wiring schematics for 75-131, 75A, 75-127EH	75B-113
Project 2/3 Submittal 17B	Installation Drawings	5/9/94	Mechanical details and instrumentation drawings.	75B-113
Project 2/3 Submittal 13	Sample Extraction Nozzles, Mass-Flow Sensor and Sample Return Flanges, and Calibration Ports.	12/3/93	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113
Project 2/3 Submittal 7	Detailed Technical Specifications	11/5/93	Description of detection systems and equipment drawings.	75B-113

APPENDIX A.
CATEGORY I STACK
EMISSION SAMPLING AND REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDING 75, ROOM 103 (continued)

Design Calculations

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 20	Seismic Safety Report	4/4/94	Structural engineering review and report for seismic safety of monitoring/sampling installations.	75B-113
Project 2/3 Submittal 18	Response to Berkeley Lab Specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113

Minimum Detectable Activities

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 18	Response to Berkeley Lab specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113

APPENDIX B
CATEGORY II-IV STACKS
EMISSION REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDINGS 56, 70A AND 88

System Summary

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 7	Detailed Technical Specifications	11/5/93	Description of detection systems and equipment drawings.	75B-113
Project 2/3 Submittal 3, 3A	Building 88 Real-Time Positron Detection System	1/3/94	Description of collection/detection system for B88.	75B-113
Project 2/3 Submittal 4, 4A	Building 56 Real-Time Positron Detection System	11/5/93	Description of collection/detection system for B56.	75B-113
Project 2/3 Submittal 15	Quality Assurance Project Plan for Instrument Installation	7/19/94	Hi-Q QAPP in tabular form for Project 2/3 sources.	75B-113
Building 70A	Building 70A CAM System	1/5/01	Description of collection/detection system for B70A.	75B-113

Sample Site Location

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 17B	Installation Drawings	5/9/94	Mechanical details and instrumentation drawings.	75B-113

Effluent Flow Rate Measurement Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 18	Response to Berkeley Lab Specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113
Project 2/3 Submittal 15	USEPA Method 2 Determination of Volumetric Flow Rate	12/15/93	EPA Method 2 stack flow rate measurement procedures provided by vendor.	75B-113

APPENDIX B
CATEGORY II-IV STACKS
EMISSION REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDINGS 56, 70A AND 88 (continued)

Sample Flow Rate Measurement Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 18	Response to Berkeley Lab Specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113
Project 2/3 Submittal 13	Sample Extraction Nozzles, Mass-Flow Sensor Flanges, Calibration Ports, Sample Return Ports and Flanges	12/3/93	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113

Sample Probe Design

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 13	Sample Extraction Nozzles, Mass-Flow Sensor Flanges, Calibration Ports, Sample Return Ports and Flanges	12/3/93	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113
HERL CAM	Building 70A CAM system	1/5/01	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113

Sample Collection Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 3, 3A	Building 88 Real-Time Positron Detection System	1/3/94	Description of collection/detection system for B88.	75B-113

APPENDIX B
CATEGORY II-IV STACKS
EMISSION REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDINGS 56, 70A AND 88 (continued)

Sample Collection Systems (continued)

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 4, 4A	Building 56 Real-Time Positron Detection System	11/5/93	Description of collection/detection system for B56.	75B-113
Project 2/3 Submittal 13	Sample Extraction Nozzles, Mass-Flow Sensor Flanges, Calibration Ports, Sample Return Ports and Flanges	12/3/93	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113

Sample Representativeness

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3	DEPOSITION Calculations	Various	Particle loss calculations for sampling lines using DEPOSITION code.	75B-113
Project 2/3 Submittal 11B	Procedure and Calculations for Particle Loss	3/25/94	Sample line particle loss test methods and results per NUREG/GR-0006.	75B-113
Project 2/3 Submittal 3, 3A	Building 88 Real-Time Positron Detection System	1/3/94	Description of collection/detection system for B88.	75B-113
Project 2/3 Submittal 4, 4A	Building 56 Real-Time Positron Detection System	11/5/93	Description of collection/detection system for B56.	75B-113

APPENDIX B
CATEGORY II-IV STACKS
EMISSION REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDINGS 56, 70A AND 88 (continued)

Design Drawings

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 4, 4A	Building 56 Real-Time Positron Det. System	11/5/93	Description of collection/detection system for B56.	75B-113
Project 2/3 Submittal 3, 3A	Building 88 Real-Time Positron Detection System	1/3/94	Description of collection/detection system for B88.	75B-113
Project 2/3 Submittal 17	Instrument Floor Plan Layout	12/15/93	Floor plans presenting equipment cabinet layout.	75B-113
Project 2/3 Submittal 17B	Installation Drawings	5/9/94	Mechanical details and instrumentation drawings.	75B-113
Project 2/3 Submittal 13	Sample Extraction Nozzles, Mass-Flow Sensor Flanges, Calibration Ports, Sample Return Ports and Flanges	12/3/93	Mechanical details for sample extraction nozzles, mass-flow sensor flanges, calibration ports, sample return ports and flanges.	75B-113
Project 2/3 Submittal 7	Detailed Technical Specifications	11/5/93	Description of detection systems and equipment drawings.	75B-113
Project 2/3 Submittal 22A	ID Tags for New Equipment	6/16/94	Vendor designs for equipment cabinet tags.	75B-113
Project 2/3 Submittal 19/17B	Flange Weights	3/24/94	Sampling pipe flange weights and architectural support details	75B-113
Project 2/3 Submittal 17	Instrument Floor Plan Layout	12/15/93	Floor plans presenting equipment cabinet layout.	75B-113
Project 2/3 Submittal 7	Detailed Technical Specifications	11/5/93	Description of detection systems and equipment drawings.	75B-113

APPENDIX B
CATEGORY II-IV STACKS
EMISSION REAL-TIME MONITORING SYSTEM DOCUMENTS

BUILDINGS 56, 70A AND 88 (continued)

Design Calculations

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 20	Seismic Safety Report	4/4/94	Structural engineering review and report for seismic safety of monitoring/sampling installations.	75B-113
Project 2/3 Submittal 18	Response to Berkeley Lab Specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113

Minimum Detectable Activities

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 18	Response to Berkeley Lab Specification from Kurz/EG&G	4/7/94	Answers to inquiries: MTFB, noise, detection limits from EG&G and Kurz Instruments.	75B-113

Measurement Uncertainties and Data Quality

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 10	QA Programs	5/26/94	Hi-Q QA Program for Berkeley Lab project, including subcontractor/vendor QA manuals.	75B-113
Project 2/3 Submittal 15	Quality Assurance Project Plan for Instrument Installation	7/19/94	Hi-Q QAPP in tabular form for Project 2/3 sources.	75B-113

APPENDIX C
CATEGORY II-IV STACKS
EMISSION SAMPLING SYSTEM DOCUMENTS

System Summary

Document ID	Title	Date	Content Summary	ESG Location
Project 1 Submittal 4	Stack Sampling Systems and Parts	7/13/94	Design details for samplers, pumps, flanges, control systems, probes.	75B-113
Project 1 Submittal 1	Project 1A/1B Phase 1 Submittal	6/24/94	Specifications of sample sites, probes, collection systems, interconnects, flowmeters/totalizers, flow controls, pumps, cabinets and detector systems.	75B-113
Project 2/3 Submittal 12	Proposal for Real-Time Isokinetic Particulate and Iodine Monitor	12/6/93	System description and mechanical details for isokinetic real-time monitoring systems at B85 Glove Box (formerly in B75-127-ABC). Note: The real-time monitoring system is used only for measuring and controlling isokinetic sampling and not radionuclide detection.	75B-113
Project 2/3 Submittal 6, 6A	Proposal for Isokinetic Particulate and Iodine Collection System	11/4/93	System description and mechanical details for isokinetic particulate and iodine collection system at B85 Hood (formerly in B75-127-E&H).	75B-113

Sample Site Location

Document ID	Title	Date	Content Summary	ESG Location
Project 1	Stack Profiling-Air Survey Report	7/5/94	Stack traverse air velocity measurements.	75B-113
Project 1 Submittal 1	Project 1A/1B Phase 1 Submittal	6/24/94	Specifications of sample sites, probes, collection systems, interconnects, flowmeters/totalizers, flow controls, pumps, cabinets and detector systems.	75B-113
Building 85 Submittal 13	"As installed" Drawings	11/8/96	"As installed" drawings of radiation monitoring and sample collection systems installed in Building 85.	75B-113

Effluent Flow Rate Measurement Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 1	Stack Profiling-Air Survey Report	7/5/94	Stack traverse air velocity measurements.	75B-113
Project 1 Submittal 4	Stack Sampling Systems and Parts	7/13/94	Design details for samplers, pumps, flanges, control systems, probes.	75B-113

APPENDIX C
CATEGORY II-IV STACKS
EMISSION SAMPLING SYSTEM DOCUMENTS (continued)

Effluent Flow Rate Measurement Systems (continued)

Document ID	Title	Date	Content Summary	ESG Location
Project 1 Submittal 3	Piping Layout	7/13/94	Plan drawings with sampling layout and equipment locations.	75B-113
Project 1 Submittal 2	Piping, Fittings, Valves, Piping Supports	5/17/94	Specifications for piping materials and components.	75B-113
Project 1 Submittal 1	Project 1A/1B Phase 1 Submittal	6/24/94	Specifications of sample sites, probes, collection systems, interconnects, flowmeters/totalizers, flow controls, pumps, cabinets and detector systems.	75B-113

Sample Flow Rate Measurement Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 1 Submittal 4	Stack Sampling Systems and Parts	7/13/94	Design details for samplers, pumps, flanges, control systems, probes.	75B-113
Project 1 Submittal 3	Piping Layout	7/13/94	Plan drawings with sampling layout and equipment locations.	75B-113
Project 1 Submittal 2	Piping, Fittings, Valves, Piping Supports	5/17/94	Specifications for piping materials and components.	75B-113
Project 1 Submittal 1	Project 1A/1B Phase 1 Submittal	6/24/94	Specifications of sample sites, probes, collection systems, interconnects, flowmeters/totalizers, flow controls, pumps, cabinets and detector systems.	75B-113
Project 2/3 Submittal 6, 6A	Isokinetic, Continuous Particulate and Iodine Collection System	11/5/93	System descriptions for B85 Hood (formerly at B75-127EH) sample flow and collection systems.	75B-113

APPENDIX C
CATEGORY II-IV STACKS
EMISSION SAMPLING SYSTEM DOCUMENTS (continued)

Sample Flow Rate Measurement Systems (continued)

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 12	Real-Time Isokinetic Particulate and Iodine Monitor	12/6/93	System description and mechanical details for isokinetic, real-time monitoring systems at B85 Glove Box (formerly in B75-127-ABC). Note: The real-time monitoring system is used only for measuring and controlling isokinetic sampling and not radionuclide detection.	75B-113

Sample Probe Design

Document ID	Title	Date	Content Summary	ESG Location
Project 1	Criteria for Use of a Single Sampling Probe Nozzle	NA	Summarizes, with supporting papers, circumstances where single nozzle probes sample representatively.	75B-113
Project 1 Submittal 4	Stack Sampling Systems and Parts	7/13/94	Design details for samplers, pumps, flanges, control systems, probes.	75B-113
Project 1 Submittal 1	Project 1A/1B Phase 1 Submittal	6/24/94	Specifications of sample sites, probes, collection systems, interconnects, flowmeters/totalizers, flow controls, pumps, cabinets and detector systems.	75B-113
Building 85 Submittal	Design Criteria for Building 85	2/17/95	Design criteria for the stack monitoring systems at Building 85.	75B-113

Sample Collection Systems

Document ID	Title	Date	Content Summary	ESG Location
Project 1 Submittal 4	Stack Sampling Systems and Parts	7/13/94	Design details for samplers, pumps, flanges, control systems, probes.	75B-113
Project 1 Submittal 3	Piping Layout	7/13/94	Plan drawings with sampling layout and equipment locations.	75B-113
Project 1 Submittal 2	Piping, Fittings, Valves, Piping Supports	5/17/94	Specifications for piping materials and components.	75B-113
Project 1 Submittal 1	Project 1A/1B Phase 1 Submittal	6/24/94	Specifications of sample sites, probes, collection systems, interconnects, flowmeters/totalizers, flow controls, pumps, cabinets and detector systems.	75B-113

APPENDIX C
CATEGORY II-IV STACKS
EMISSION SAMPLING SYSTEM DOCUMENTS (continued)

Sample Collection Systems (continued)

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 8, 9	Filter Holder Design	11/19/93	Filter holder mechanical details for Building 85 (formerly in 75-127EH collection systems).	75B-113
Project 2/3 Submittal 6, 6A	Isokinetic, Continuous Particulate and Iodine Collection System	11/5/93	System descriptions for Isokinetic continuous particulate and iodine collection systems at Building 85 Hood (formerly in B75-127EH).	75B-113
Project 2/3 Submittal 12	Real-Time Isokinetic Particulate and Iodine Monitor	12/6/93	System description and mechanical details for isokinetic, real-time monitoring systems at B85 Glove Box (formerly in B75-127-ABC). Note: The real-time monitoring system is used only for measuring and controlling isokinetic sampling and not radionuclide detection.	75B-113

Sample Representativeness

Document ID	Title	Date	Content Summary	ESG Location
Project 1	Criteria for Use of a Single Sampling Probe Nozzle	NA	Summarizes, with supporting papers, circumstances where single nozzle probes sample representatively.	75B-113
Building 85 Submittal 11	Particle Loss Estimation	9/6/96	Particle loss estimation for monitoring systems at Building 85 using Deposition 2.0 software	75B-113

Design Drawings

Document ID	Title	Date	Content Summary	ESG Location
Project 1 Submittal 5	Electrical Submittals	6/24/94	Specifications of electrical components.	75B-113
Project 1 Submittal 3	Piping Layout	7/13/94	Plan drawings with sampling layout and equipment locations.	75B-113
Project 1 Submittal 2	Piping, Fittings, Valves, Piping Supports	5/17/94	Specifications for piping materials and components.	75B-113
Project 1 Submittal 1	Project 1A/1B Phase 1 Submittal	6/24/94	Specifications of sample sites, probes, collection systems, interconnects, flowmeters/totalizers, flow controls, pumps, cabinets and detector systems.	75B-113

APPENDIX C
CATEGORY II-IV STACKS
EMISSION SAMPLING SYSTEM DOCUMENTS (continued)

Design Drawings (continued)

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 6, 6A	Isokinetic, Continuous Particulate and Iodine Collection System	11/5/93	System descriptions for B85 Hood (formerly at B75-127EH) sample flow and collection systems.	75B-113
Project 2/3 Submittal 12	Real-Time Isokinetic Particulate and Iodine Monitor	12/6/93	System description and mechanical details for isokinetic, real-time monitoring systems at B85 Glove Box (formerly in B75-127-ABC). Note: The real-time monitoring system is used only for measuring and controlling isokinetic sampling and not radionuclide detection.	75B-113

Design Calculations

Document ID	Title	Date	Content Summary	ESG Location
Building 85 Submittal	Design Criteria for Building 85	2/17/95	Design criteria for the stack monitoring systems at Building 85.	75B-113

Minimum Detectable Activities

Document ID	Title	Date	Content Summary	ESG Location
Analytical Lab Specifications	Statement of Work for Analytical Services	1995	Analytical laboratory specifications that govern sample analyses performed for the NESHAP compliance program including MDAs.	75B-113

APPENDIX C
CATEGORY II-IV STACKS
EMISSION SAMPLING SYSTEM DOCUMENTS (continued)

Measurement Uncertainties and Data Quality

Document ID	Title	Date	Content Summary	ESG Location
Project 2/3 Submittal 10	QA Programs for Instrument Installation	5/26/94	Hi-Q QA Program for Berkeley Lab project, including subcontractor/vendor QA manuals.	75B-113

Justification for Exceptions to Standards

Document ID	Title	Date	Content Summary	ESG Location
Project 1	Criteria for Use of a Single Sampling Probe Nozzle	NA	Summarizes, with supporting papers, circumstances where single nozzle probes sample representatively.	75B-113

APPENDIX D. ANALYTICAL LABORATORY QUALITY ASSURANCE SUMMARY

Radioanalytical Methods for NESHAP Samples

NESHAP analytical methods are categorized as primary and secondary methods. Primary methods are rapid, conservative screening methods used to determine significant positive activity in NESHAP samples. The primary methods are presented in Table D-1.

Some primary methods may involve techniques that do not meet EPA Method 114, Table 1 specifically approved methods for nuclides potentially in the sample. Using conservative predetermined action levels, the primary methods conservatively identify potential emissions for secondary analysis. The secondary analyses that are utilized fully meet the EPA Method 114, Table 1 approved methods.

Table D-1. Primary Screening Radioanalytical Methods for NESHAP Samples

Analyte	Collection Medium	Measurement Method	Part 61 App. B Method 114 references
Alpha/Beta emitters	Particulate Filter	Gas Proportional Counting	Method A-4 Direct Alpha Counting for gross alpha determination. Method B-4 Direct Beta Counting for gross beta determination.
Radioiodine	Charcoal Cartridge	Gamma Counting	Method G-1 or G-2
Carbon-14	NaOH solution	Liquid Scintillation Counting	Method B-5 Liquid Scintillation Spectrometry
Tritium	Indicator Silica Gel	Liquid Scintillation Counting	Method B-5 Liquid Scintillation Spectrometry

APPENDIX D. ANALYTICAL LABORATORY QUALITY ASSURANCE SUMMARY (continued)

Table D-2 summarizes the number and frequency of quality control checks. Replicates, spiked samples, split samples, and blanks are included where applicable, in accordance with Method 114, paragraph 4.5. Section 6 of the QAPP defines each type of quality control sample.

Table D-2. Laboratory Quality Control Sample Summary

Sample Type	Analyte	Blank Sample	Matrix Spike Sample	Performance Evaluation Sample	Laboratory Duplicate or Split	Laboratory Control Sample
Particulate Filter (25 mm)	Gross αβ	1/sample batch	none	1/qtr	1 repeat / batch	1/sample batch
Particulate Filter (47 mm)	Gross αβ	1/sample batch	none	1/qtr	1 repeat / batch	1/sample batch
Particulate Filter (8 inch)	Gross αβ	1/sample batch	none	1/qtr	1 repeat / batch	1/sample batch
Charcoal Cartridge	Radioiodine	1/sample batch	none	1/qtr	1 repeat / batch	1/sample batch
Indicator Silica Gel	Tritium	1/sample batch	1/sample batch*	none	1 split/ batch**	1/sample batch
NaOH Bubbler Solution	C-14	1/sample batch	1/sample batch	none	1 split/ batch	1/sample batch

* Spiked sample water extracted from silica gel.
** Split of sample water extracted from silica gel.